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MYLONITES OF THE UPPER KIEWA VALLEY

By F. C. Beavis

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Abstract

Mylonites which occur in the metamorphic complex of the Upper Kiewa Valley are invariably associated with faults. Greywackes, schists, gneisses, granodiorites and lamprophyres have been involved.

Comparison of the mineral associations of the parent rocks with those of the mylonites indicates mylonitization under hydrous conditions with moderately high pressure and temperature, and the application of intense shearing stress. Felspars, sillimanite, almandine, amphibole and pyroxene are the most unstable of the minerals under these conditions.

The fabric of all the rocks examined is one due to flattening. The fabric of secondary, post-deformation quartz has been controlled by the orientation of quartz nuclei in the matrix of the mylonites.

Introduction

Previous studies (Tattam 1929, Crohn 1949) of the metamorphic complex of NE. Victoria have indicated that the rôle of shearing stress in the regional metamorphism was insignificant. Howitt (1892), however, in a study of the boundary between the Ordovician sediments and schists in the Upper Dargo, found evidence of the development of strong shearing stresses in this area.

Crohn (*op. cit.*) commented on the asymmetry of the schist belts flanking the core gneisses of the complex in the Omeo–Kiewa area. No explanation of this asymmetry was suggested. During mapping of the Upper Kiewa Valley, the writer found that the rocks of the narrow W. schist belt are, in fact, mylonites, formed as a result of shearing during movement on the West Kiewa Thrust which here forms the boundary between the metamorphic rocks and the normal Upper Ordovician sediments. The mylonites of this belt contrast strongly with the normal schists of the very wide E. belt.

While the mylonite belt of the West Kiewa Thrust is the dominant one of the area, a number of others of somewhat lesser dimensions occur, all associated with faulting. Mylonitization of Ordovician greywackes, schists, 'permeation gneiss' (migmatite), granodiorite, and lamprophyre has been observed. The present study has attempted to trace both textural and mineralogical changes which occurred during cataclasis, and from this, following the work of Hsu (1955), to determine the physical conditions of the faulting.

Nomenclature and Previous Literature

Lapworth (1885) defined mylonites as 'microscopic friction breccias, with fluxion structure, in which the interstitial . . . paste has recrystallized in part'. Knopf (1931) considered that the development of mylonite was not to be considered as synonymous with fault brecciation or with the development of fault gouges. The essential difference is that gouge and breccia are incoherent or recemented, while mylonite has been formed under such conditions that coherence was not lost. Knopf believed that while mylonitization is essentially a cataclastic process, there is a variable amount of recrystallization, dependent on the conditions of deformation and the composition of the original rock. Where, due to recrystallization, the original cataclasis is recognizable only with difficulty, Knopf refers to the rock as a blastomylonite. Sander (cited by Knopf) has claimed that a blastomylonite is produced by a deformation that is partly ruptural and partly crystalloblastic, not by the rehealing crystallization of a mylonite.

Waters and Campbell (1935) considered that mylonites were coherent at all stages of their formation, with any recrystallization insignificant. The work of Adams and Bancroft (1917) who experimentally produced mylonitic textures, is cited by these authors in support of their ideas.

Turner and Verhoogen (1951) stated that mylonites are the product of almost pure cataclasis, and that as chemical processes enter more and more into the deformation, there is a continuous transition to augen gneiss, mylonite gneiss, flaser rock, and blastomylonite

The most important recent work on cataclasis is that of Hsu (1955). Hsu considered that frequently the evidence available is inadequate to determine the rôle of recrystallization in the formation of mylonites. Hsu recognized two main classes of cataclastic rocks: mylonites, which are foliated, and cataclasites which show neither foliation nor lineation. On the basis of the relative proportion of aphanitic matrix present, Hsu recognized protocataclasites and protomylonites (less than 50% aphanitic material), and ultracataclasites and ultramylonites (more than 90% aphanitic material). True mylonites and cataclasites were defined to comprise between 50% and 90% aphanitic matrix.

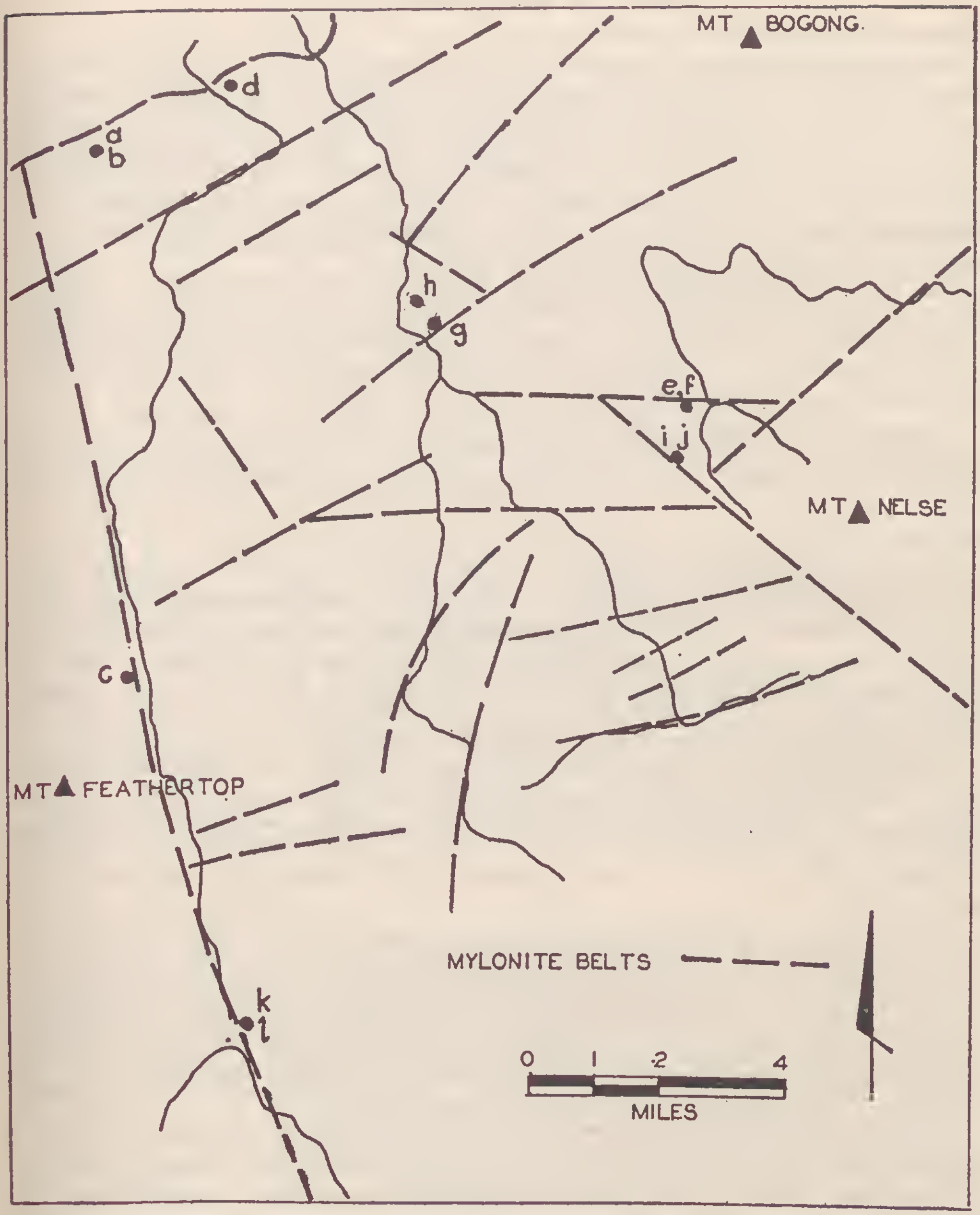
Distribution of Cataclastic Rocks in the Upper Kiewa Valley

The most important mylonite belt, that associated with the West Kiewa Thrust, has been traced from the Upper Dargo R., along the West Kiewa Valley, to near the township of Mt Beauty. At Mt Beauty, the belt terminates on the Tawonga Fault, N. of which no certain evidence of the belt has been found. The West Kiewa mylonite has an outcrop width of almost one mile. Contained within the belt are schist lenses of small dimensions. In age, this mylonite predates the granodiorites, since the Niggerheads granodiorite is in part intrusive into it. Mylonitization of this granodiorite is restricted to very narrow zones which transgress the West Kiewa belt also, and are therefore younger than both the granodiorite and the West Kiewa mylonite.

The mylonite and cataclasite of the Tawonga Fault post-date the granodiorites, since rocks of this type on the West Kiewa and East Kiewa R. have been involved. The Tawonga Fault mylonite is less well defined as a belt than that of the West Kiewa Thurst, and is also narrower; the maximum outcrop width of any one belt is not more than 200 ft. Renewed movement on the Tawonga Fault during the Tertiary (Beavis 1960) resulted in brecciation of this mylonite. No recementation of the breccia has taken place.

The other important mylonites are those associated with the Nelse and Spion Kopje Faults. These have a maximum outcrop width of 50 ft. All other mylonites examined are of restricted extent (Fig. 1) and occupy zones of less than 5 ft width.

Gouge and breccia occur on the younger faults. These are known mainly from exposures in excavations; natural exposures, restricted to stream beds developed on the crush zones, are generally obscured by debris.


MT BOGONG.
d
a
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MT NELSE
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MT FEATHERTOP
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MYLONITE BELTS
0 1 2 4
MILES

Fig. 1

Petrology of the Cataclastic Rocks

GREYWACKE MYLONITES

Apart from restricted development on the Tawonga Fault, mylonites derived from the Upper Ordovician greywackes are found chiefly as narrow zones between Mt St Bernard and Mt Hotham. The texture of the original greywacke is medium with maximum grain size 1·5 mm. Grading is poor. Angular to subangular grains of quartz, with rare marginal recrystallization, oligoclase, and rare alkali felspar occur in a fine matrix of quartz, felspar, chlorite, sericite and kaolinite, the matrix comprising from 20% to 70% of the whole. Detrital almandine, tourmaline, magnetite, biotite, zircon, and andalusite are accessory.

In the cataclastic derivatives, which have a protocataclastic texture, quartz occurs as crushed aggregates, together with oligoclase, less crushed, but partially sericitized. The original matrix appears to have undergone some reconstitution, with the production of sericitic aggregates and small porphyroclasts of quartz. Any alkali felspar originally present has been sericitized.

Any slates interbedded with the greywackes have been occasionally reduced to extremely fine grained ultramylonites. Failure in the slates, however, is more typically by pure flow, with very little textural or mineralogical variation.

SCHIST MYLONITES

Generally only high grade schists occur in the area examined. Restricted lenses of a low grade quartz-biotite-felspar schist and quartz-albite-epidote schist occur on the W. margin of the West Kiewa mylonite belt, at Cobungra Gap. The high grade schists include the knotted schist of Mt Bogong, which has a mineral assemblage characteristic of the Hornblende Hornfels Facies of Fyfe, Turner and Verhoogen (1958). These rocks are quartz-cordierite (-pinite)-felspar schists, in which pinite occurs as elliptical knots after cordierite.

On Mt Bogong, and in the Mt Nelse area, normally foliated schists as well as knotted schists occur with the assemblage of the Hornblende Hornfels Facies transitional to the Almandine Amphibolite Facies. These include quartz-biotite-cordierite (-pinite)-sillimanite-muscovite schists, quartz-hornblende-almandine-oligoclase-cordierite schist, and quartz-felspar-sillimanite-cordierite-almandine-biotite schist.

Mylonites developed from low grade schist occur at Cobungra Gap (Pl. X, fig. 1). The biotite has undergone severe deformation, and has been sheared into fine foliae which curve around small lenses of quartz and felspar; both the quartz and felspar are strained, and sericitization of the felspar is advanced. In a specimen of a more arenaceous type from the same locality, the lenses do not consist of single crystals, but of aggregates of crushed quartz and felspar, the latter strongly sericitized. The texture of this rock is protomylonitic.

A high grade schist mylonitized by the West Kiewa Thrust movement has a distinct foliated mylonitic texture. The aphanitic matrix is composed essentially of fine quartz, with rare felspar almost completely sericitized, and fine flakes of light brown, strongly pleochroic biotite. Porphyroclasts, up to 0·3 mm. in diameter, consist of dark brown biotite, quartz showing irregular strain lamellae, and strongly poikiloblastic almandine, often severely cracked, invariably with corroded margins, and showing replacement by magnetite and cordierite. Sillimanite is absent.

Gneiss Mylonites

The permeation gneiss at Kiewa is a migmatite which is markedly heterogeneous in texture, as well as showing quite wide variations of composition. Quartz, orthoclase, orthoclase microperthite, microline, andesine, biotite, sillimanite, and cordierite are the main constituents. Almandine is frequently, but not invariably, present. The quartz encloses needles of sillimanite, and near the crystal boundaries may show intergrowth with alkali felspar. Biotite may be replaced wholly or in part by sillimanite.

Cataclastic derivatives of the gneiss have been studied from the West Kiewa Thrust, and the Spion Kopje (Pl. X, fig. 2), Nelse (Pl. X, fig. 3) and Tawonga Faults. Most are true mylonites, but protocataclasites occur on the Tawonga Fault, and ultramylonite on the Spion Kopje Fault. The mylonites have thin aphanitic bands composed of quartz, sericite, and finely divided biotite. Porphyroclasts are of quartz, felspar, rare white mica, and cordierite. Crushing of the felspar varies from slight in the Nelse mylonite, to extreme, with advanced sericitization, in the Spion Kopje mylonite

In the West Kiewa Thrust, it is possible to trace increasing severity of mylonitization of the gneiss. The micas were first affected, with elongation of the flakes, and the development of a selvedge of isotropic material along the crystal boundaries, and sometimes along the cleavage planes. Granulation of quartz and then felspar followed, with marginal sericitization of the felspar, and more intense deformation of the micas. At this stage, the sillimanite was converted to a fine sericitic material. The final stage was marked by the more or less complete crushing of the felspars and the development of the true mylonite texture.

The protocataclasite from Mt Beauty, developed on the Tawonga Fault, is coarse textured, with the average diameter of crystals 2 mm. The quartz has been granulated, the micas reduced to a fine powder, and the felspars completely replaced by green waxy micaceous aggregates which X-ray studies showed to be pyrophyllite.

In the crush zone of the Spion Kopje Fault, at Bogong township, a fine mylonite, with dense cryptocrystalline material constituting 70% of the rock, passes into a glassy ultramylonite, with a few small aggregates of recognizable sericite.

Granodiorite Mylonite

The granodiorite of the Kiewa area is fine to medium grained, and even textured. It is composed essentially of quartz, andesine in excess of orthoclase and orthoclase microperthite, biotite, occasionally hornblende, and muscovite, with cordierite, apatite, sphene, and zircon accessory.

A granodiorite protomylonite from the Tawonga Fault (Pl. X, fig. 5) at Young's Gap consists of aphanitic bands of quartz and felspar, with relatively large flakes of white mica. Quartz and felspar occur also as single crystal porphyroclasts, as well as granulated aggregates. Sericitization of the felspar has occurred, but has not been severe. Similar protomylonites were observed at Clover Dam, and at Bogong.

In these rocks, the first evidence of deformation is the development of strain shadows in the quartz. This is followed by shearing of the biotite, and the development of intergranular isotropic material, producing mortar structure. Cracking of the quartz and felspar follows, with an increase in the amount of aphanitic material until the more or less uncrushed crystals remain as porphyroclasts.

Lamprophyre Mylonites

Both augite and hornblende lamprophyres occur in the area, together with a number of variants. These are characterized by panidiomorphic texture, with phenocrysts of augite and/or hornblende, and plagioclase set in a fine groundmass of felspar and ferromagnesian minerals.

Several examples of mylonitized lamprophyre have been studied. In all cases, the resultant rock is an aggregate of sericite and chlorite. Most of these mylonites show advanced replacement by secondary minerals, introduced during post-deformation metasomatism.

Mineralogical Changes due to Cataclasis

The main mineralogical changes associated with mylonitization are summarized in Table 1.

Table 1

Mineralogical Changes with Mylonitization

Parent rock	Mineral assemblage	Mineral assemblage of cataclastic derivatives
Greywacke	Quartz, felspar, sericite.	Quartz, sericite, felspar.
Schist (Albite-epidote Hornfels Facies)	Quartz, biotite, felspar, epidote.	Quartz, sericite, biotite.
Schist (Hornblende Hornfels Facies, transitional to Almandine Amphibole Facies)	Quartz, biotite, cordierite, almandine, sillimanite, felspar, hornblende.	Quartz, sericite, almandine, cordierite, biotite, iron ore.
Granodiorite	Quartz, felspar, biotite, muscovite.	Quartz, sericite, muscovite, felspar, biotite. Quartz, sericite.
Permeation Gneiss	Quartz, felspar, cordierite, sillimanite, almandine.	Quartz, sericite, muscovite, cordierite, biotite, felspar. Quartz, cordierite, muscovite, felspar, sericite. Quartz, pyrophyllite.
Lamprophyre	Augite, hornblende, felspar.	Sericite, chlorite.

The most unstable minerals during mylonitization of the rocks examined were the felspars, sillimanite, almandine, augite, and hornblende. Since both augite and hornblende are unstable, it is apparent that mylonitization of the lamprophyres occurred with the development of high temperatures under somewhat hydrous conditions (see Table 2). The instability of almandine is of interest. Tilley (1926) recorded the breakdown of almandine to cordierite and magnetite in contact aureoles. Such breakdown, whether conditions were 'wet' or 'dry', shows that the stability field of garnet has been exceeded (Yoder 1955), and it is probable that both temperature and pressure were high.

The felspars are invariably replaced by fine micaceous aggregates such as sericite and pyrophyllite. The replacement of sillimanite by sericite and quartz indicates some reaction between the sillimanite and felspar. Biotite, except for a slight colour change, shows no breakdown.

Cordierite, with quartz, is one of the most stable of the minerals; there is no evidence of change in this mineral, while the evidence of the narrow 10A line in X-ray powder patterns of the pinite supports the ideas of Tattam (1929) that the pinitization of the cordierite was not influenced by shearing stress.

Chemical analyses of the mylonites and of the parent rocks were made, but were of little value because of wide variations in compositions of both sets. This is reflected in the SiO_2 and Al_2O_3 particularly, where analyses 5 and 6 are typical of slates and analyses 1 and 2 of subgreywackes. The only reasonably consistent change recorded was gain in H_2O+ during mylonitization, but a loss of this constituent was also recorded in one case. Any loss of K_2O is associated with mylonitization of potash felspar.

TABLE 2

Chemical Analyses

	1	2	3	4	5	6	7	8
SiO_2	75·45	70·49	65·50	79·42	58·35	56·15	67·81	25·75
Al_2O_3	13·76	17·73	14·75	10·75	21·45	21·55	14·96	4·10
Fe_2O_3	1·21	1·04	3·13	3·75	0·79	0·55	0·76	0·16
FeO	2·09	1·56	2·20	0·12	4·51	5·55	0·60	5·60
TiO_2	0·51	0·36	0·34	0·51	0·80	0·85	0·45	0·05
CaO	0·24	0·04	3·28	0·29	0·78	0·93	2·95	21·36
MgO	1·40	0·03	1·06	0·21	2·15	3·10	1·70	5·01
Na_2O	0·45	1·40	3·80	0·40	0·90	0·98	3·44	0·75
K_2O	3·47	1·31	3·12	2·11	5·30	6·15	0·59	0·64
MnO	0·03	1·60	0·07	0·02	0·06	0·20	0·02	0·25
P_2O_5	0·08	2·80	0·13	0·05	0·15	0·14	0·10	0·05
CO_2	-	-	-	-	-	-	5·19	30·12
H_2O-	0·12	0·13	0·12	0·37	0·86	0·41	0·35	0·10
H_2O+	2·01	1·30	0·83	2·90	3·55	3·35	0·41	0·80
S	-	-	-	-	-	-	-	5·01
Total	100·82	99·79	99·33	100·90	99·66	99·91	99·33	99·75

Analyst: S. Biskupsky

1. Low grade schist, Cobungra Gap.
2. Permeation gneiss, Timm's Lookout.
3. Granodiorite, Bogong.
4. Schist mylonite, Cobungra Gap.
5. Gneiss mylonite, Dibbin's Lookout.
6. Gneiss mylonite, Diamantina R.
7. Granodiorite mylonite, Bogong.
8. Metasomatized granodiorite mylonite, Bogong.

NEOMINERALIZATION OF THE MYLONITES

Apart from the recrystallization which sometimes accompanied cataclasis, many of the mylonites show some post-deformation recrystallization and metasomatic replacement. The most important has been the recrystallization of sericite in the aphanitic matrix, the introduction of secondary quartz, pyrite, and epidote to the matrix, and along s planes, and the widespread introduction of calcite.

A mylonite derived from low grade schist in the West Kiewa Thrust has been recrystallized during post-deformation intrusion of the Niggerheads granodiorite. The mylonitic texture has not been appreciably modified, but much of the sericite has been recrystallized to muscovite, while pale brown biotite is strongly developed. Small crystals of pale mauve cordierite are abundant; this mineral is absent from the mylonite some distance away from the contact. The quartz shows evidence of recrystallization in as much as the strain phenomena, typical in the mylonite away from the contact, are absent. The few felspar grains present have cores of zoisite, replacing the calcic cores of the felspar.

PETROFABRIC ANALYSES

Petrofabric analyses were completed for 8 mylonites from sections cut parallel to the ab and bc fabric planes. Practical difficulties were encountered because of the smallness of the grains. Moreover, the few porphyroclasts did not permit the desirable statistical comparison of the orientation of the porphyroclasts and that of the grains forming the matrix. Where possible, both quartz and mica fabric were examined.

Turner and Verhoogen (1951) considered that the dominant movement concerned in the formation of mylonites was sliding on a single set of s planes, with some rotation of the larger surviving grains about b occurring simultaneously. Sander (1930) and Knopf and Ingerson (1938) showed that from a study of quartz fabrics, 'single group slip', with some rotation, occurs in zones of intense shearing and mylonitization. The simplest form of tectonic flow is explicable as displacement along a single group of slip planes; where these planes are equally developed and symmetrically disposed about their axes of intersection, the two planes of each pair develop as a result of flattening. Due to the flattening movement, the deformed grains become progressively flatter and lie in the surface of flattening which is the visible s of the fabric. This dimensional orientation, shown particularly in Pl. X, fig. 1-5, is the result of shearing slip along planes oblique to the visible s. The optic axes of quartz grains are not parallel to the long axes of the grains, but, statistically, form a maximum on h01 planes, symmetrically disposed about ab. The deformation responsible for the flattening is a compression normal to ab. This restricts the forward movement parallel to a, with little or no rotation about b.

Lineation parallel to b is present in all the mylonites. This is due to the flattened quartz and mica exposed on the foliation planes, and has the appearance of slickensides. One slickensided face (Fig. 2d) was examined. Sander (1930) restricts the term slickenside to individual surfaces of slipping, characterized by a lineation that coincides with the a fabric axis, i.e. the direction of movement. Sander described a slickensided mylonite from Melibokus, and found that biotite crystals showed a tendency to lie with 001 parallel to the lineation, giving a girdle pattern in the fabric diagram which identified the lineation as parallel to b. Grains of quartz were found to be elongated at right angles to the lineation, thus giving a microscopic second lineation. The quartz grains showed a preferred orientation with the optic axes parallel to s and normal to the lineation, parallel to the a fabric axis.

The slickensided mylonite examined from Kiewa was less than 1 mm. thick. Lineation was parallel to b. Study of the biotite was not possible, because of the intense deformation of this mineral. The quartz diagram (Fig. 2d) is of some interest. Two maxima occur; one parallel to a, as found by Sander, and a second which may be regarded as lying on a h01 plane which makes an angle of 40° with the ab of the fabric. This is almost certainly of no real significance, probably representing the fabric of the normal gneiss observed in analyses of such rocks. In

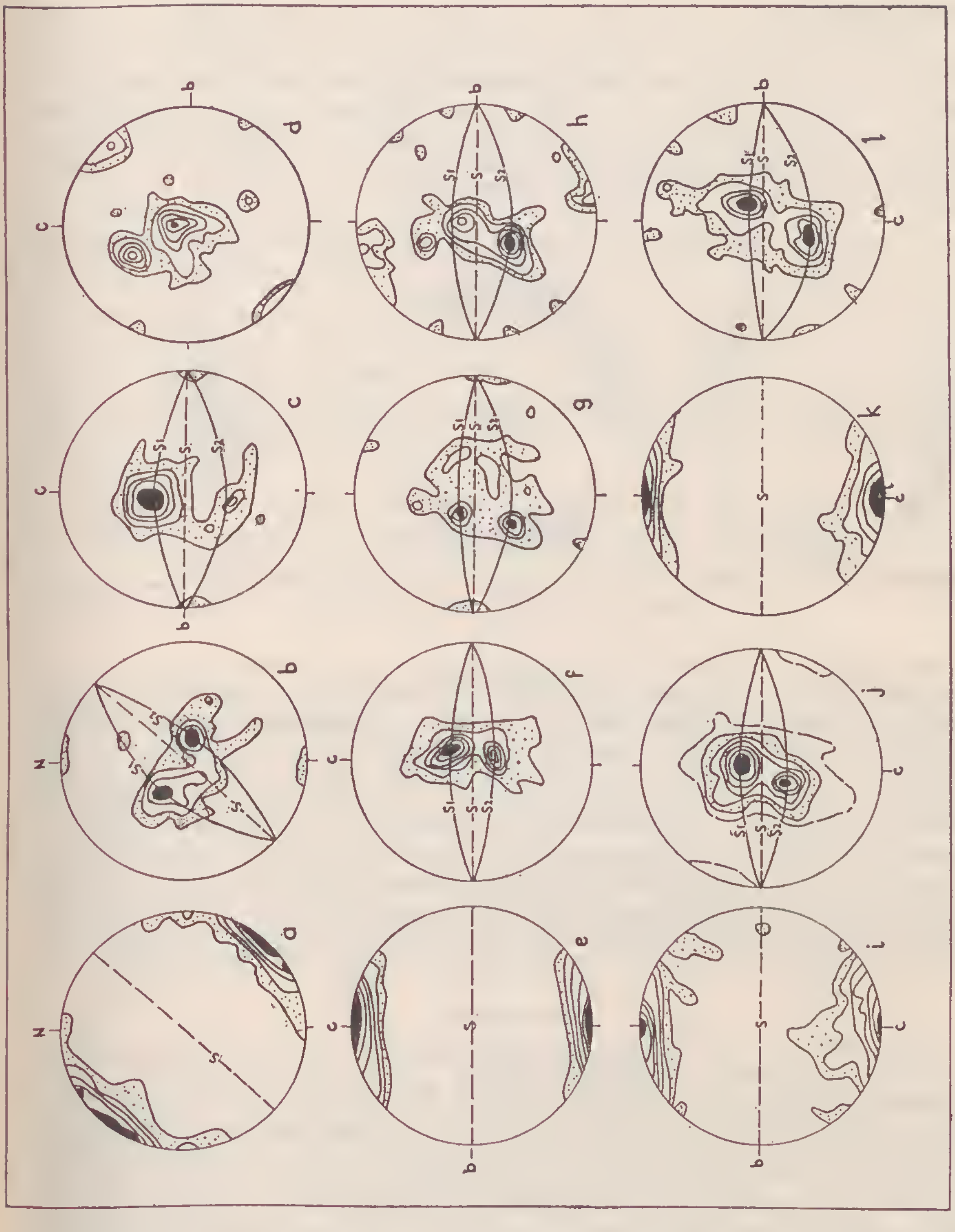

Fig. 2

cutting the section from the thin mylonite, some of the undeformed rock was probably included.

Where study of the biotite fabric of the mylonites was possible, it was found that maxima of the poles to cleavage planes occurred in c normal to the visible s. All of the quartz diagrams show the orthorhombic symmetry of the flattening movement, with two intersecting sets of h01 planes. Maxima on each of these planes may be equally developed, but usually one is slightly stronger than the other. Mylonitization in every case appears effectively to have destroyed any earlier fabric, evidence of which was found only in isolated cases.

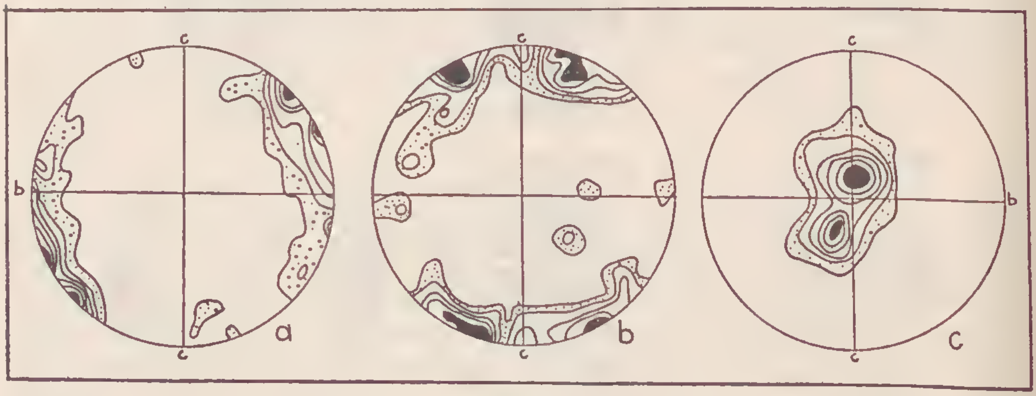

Fig. 3

The fabrics of secondary quartz (Pl. X, fig. 3) and calcite (Pl. X, fig. 6) introduced into the mylonites during post-deformation metasomatism are shown on Fig. 3. The calcite crystals show no evidence of deformation. In each of the two cases examined, different patterns were obtained for the orientation of the optic axes. The orientations do not agree with control by shear planes, or by the walls bounding the veins (cf. Knopf and Ingerson *op. cit.*), and no explanation of the orientation can be offered. For the quartz vein in mylonite (Fig. 3c) the orientation is identical for the quartz of the mylonite. There is no evidence of deformation of the quartz grains of the vein. Turner (1942) in a study of quartz veins in schist, found that the orientation was controlled by the walls of the vein. No such control exists here, and it is considered that the grains developed in optical continuity with nuclei of fine quartz in the matrix of the mylonite.

Discussion

Hsu (1955), in discussing the mylonites from the San Gabriel Mountains, California, found that mylonitization involved a retrograde metamorphism, thus confirming the earlier work of Knopf (1931). Hsu believed that the composition of a rock is important in determining its mode of deformation. Rocks of different composition when subjected to a shearing stress, under a given set of P (hydrostatic pressure), T (temperature), and X (partial pressure of hydrous phase) conditions, may undergo different modes of deformation, just as under differing PTX conditions rocks of the same composition may undergo different modes of deformation. On this basis, Hsu concluded that mylonitic textures alone give no indication of either PTX conditions, or the intensity of the shearing stress at the time of deformation. The PTX conditions can only be assessed by a study of mineral associations in the mylonites and the granoblastic rocks associated with the mylonites, while the intensity of the shearing stress can be estimated only by comparing textures of rocks of the same composition formed under the same PTX conditions.

The Kiewa mylonites are invariably associated with faults, the movement on which, responsible for the mylonitization, can be dated at, as youngest, late middle Palaeozoic. The younger fault movements produced breccia and gouge. Work in progress by the writer has shown that only one folding (Benambran) has affected the area, and that the stresses of the younger orogenies have resulted in faulting and jointing, without the superposition of folds. This indicates that, at the time of stress application, the rocks were not in a plastic condition, and that therefore the depth was not great. Both the mineral associations of the mylonites and the lack of any evidence that these rocks were other than coherent at all stages of their formation, suggest moderate pressure and temperature conditions. The evidence of the mineral associations suggests conditions approximating to those of the Hornblende Facies, so that, using the criteria of Hsu, it can be concluded that the mylonitic textures here represent the localized application of intense shearing stress.

Although shearing has been most effective in the zones of mylonitization, fabric studies of the normal rocks show some evidence of the effects of shear, traces of a flattening fabric being found in a number of cases, superimposed on the original fabric. The effect on the mineralogy of the normal rocks has been negligible; in fact, on this basis alone there is virtually no evidence of shear.

Conclusions

Mylonites and cataclasites occur in association with both wrench and thrust faults of Palaeozoic age in the Upper Kiewa Valley. Petrographic and petrofabric studies, as well as the field evidence, suggest that these rocks were derived from the parent sediments, schists, gneisses and igneous rocks, under conditions of moderate pressure and temperature, and high shearing stress. There is evidence of slight recrystallization accompanying cataclasis; similarly, the evidence indicates coherence of the rock during mylonitization. The study of neomineralization of the mylonites showed that the secondary quartz crystallized on nuclei within the matrix of the mylonites, and adopted the orientation of these nuclei. No control of the orientation of the secondary calcite can be suggested, and further work to investigate this aspect will be necessary.

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Explanation of Plate

Plate X

Photomicrographs of Mylonites

Fig. 1—Schist mylonite, West Kiewa Thrust.
Fig. 2—Gneiss mylonite, Spion Kopje Fault.
Fig. 3—Gneiss mylonite, with secondary quartz vein, Nelse Fault.
Fig. 4—Granodiorite mylonite, Niggerheads.
Fig. 5—Granodiorite protomylonite, Tawonga Fault.
Fig. 6—Metasomatized granodiorite mylonite, Bogong.
All photographs in ordinary light.

Explanation to Figures

Fig. 1—Faults in the Kiewa Area. Small letters (a, b, c etc.) refer to localities of specimens analyzed—see Fig. 2.

Fig. 2—Petrofabric Diagrams, Mylonites.

a. Granodiorite protomylonite, Tawonga Fault, Young's Gap. Poles to 200 cleavage planes, mica. Contours 9–7–5–3–1%.
b. Same specimens as a. Optic axes of 207 quartz crystals. Contours 8–6–4–2%.
c. Schist mylonite, West Kiewa Thrust, Diamantina R. Optic axes 110 quartz crystals. Contours 10–8–6–4–2%.
d. Slickensided mylonite, West Kiewa. Optic axes of 200 quartz crystals. Contours 12–10–8–6–4–2%.
e. Gneiss mylonite, Spion Kopje Fault, Timm's Lookout. Poles to 300 cleavage planes of biotite. Contours 10–8–6–4–2–1%.
f. Same specimen as e. Optic axes of 106 quartz crystals. Contours 12–10–8–6–4–2%.
g. Granodiorite mylonite, Bogong. Optic axes of 200 quartz cystals. Contours 8–6–4–2%.
h. Neomineralized granodiorite mylonite, Bogong. Optic axes of 83 quartz crystals. Contours 8–7–5–3–2–1%.
i. Gneiss mylonite, Nelse Fault, Spion Kopje ridge. Poles to 121 cleavage planes of biotite. Contours 13–11–9–7–5–3–1%.

j. Same specimen as i. Optic axes of 298 quartz crystals. Contours 12–10–8–6–4–2–(½)%.
k. Schist mylonite, West Kiewa Thrust, Cobungra Gap. Poles to 105 cleavage planes of biotite. Contours 9–7–5–3–1%.
l. Same specimen as k. Optic axes of 314 quartz grains. Contours 9–7–5–3–1%.

Fig. 3—Secondary Veins in Mylonite.
a. Same specimen as Fig. 2g. Optic axes of 110 calcite crystals. Contours > 11–9–7–5–3–1%.
b. Same specimen as Fig. 2h. Optic axes of 200 calcite crystals. Contours > 9–7–5–3–2%.
c. Same specimen as Fig. 2i. Optic axes of 306 quartz crystals. Contours > 11–9–7–5–3–1%.

The fabric axes of the diagrams are those of the mylonites containing the veins. Walls of veins are parallel to ab.